REMARKS

I. Status of the Application

By the present Amendment, Applicants are amending claims 1, 16, 17, and 23. No new matter is added. Claims 1-17, 21, and 23 are all the claims currently pending in the application. Claims 1-17, 21, and 23 have been rejected. The present Amendment addresses each point of rejection raised by the Examiner. Favorable reconsideration is respectfully requested.

II. Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-3, 6, and 17 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over "Low Threshold Current GaInAsP/InP DFB Laser," IEEE J. Quantum Electron., Vol. QE-23, No. 6, June 1987, pp. 828-834 to Itaya et al. (hereinafter "Itaya") in view of U.S. Publication No. 2003/0091080 to Aoyagi et al. (hereinafter "Aoyagi"). Claims 4 and 5 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Itaya and Aoyagi in view of U.S. Patent No. 4,740,987 to McCall, Jr. et al. (hereinafter "McCall"). Claims 7-15 and 21 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Itaya and Aoyagi in view of U.S. Publication No. 2003/0021319 to Aoki et al. (hereinafter "Aoki"). Claims 16 and 23 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Itaya and Aoyagi in view of U.S. Patent No. 5,610,930 to Macomber et al. (hereinafter "Macomber"). Applicants respectfully traverse these grounds of rejection.

Claim 1 recites a distributed-feedback (DFB) semiconductor laser wherein a combination of the coupling coefficient κ of the diffraction grating and the length L of the active region provides a $\Delta\alpha/g_{th}$ of 1 or more. Claim 1 defines $\Delta\alpha$ as a gain difference between modes, and g_{th} as a threshold gain.

As the Examiner acknowledges, Itaya fails to teach or suggest that a combination of the coupling coefficient κ of the diffraction grating and the length L of the active region provides a $\Delta\alpha/g_{th}$ of 1 or more. However, the Examiner asserts that Aoyagi discloses this feature, and that it would have been obvious to a person of ordinary skill in the art to modify the DFB laser of Itaya such that $\Delta\alpha/g_{th}$ is 1 or more, in order to achieve a stable single axial mode. Applicants respectfully disagree.

Aoyagi is directed to a DFB laser (¶ [0036]). In the second embodiment of Aoyagi, the following relationships are satisfied: $L \leq 260$ μm and $7\ cm^{-1} \leq \alpha th \leq 51\ cm^{-1}$, where αth is the power threshold gain per unit length (¶¶ [0044] and [0060]). Also, Aoyagi discloses that the threshold power gain difference $\Delta\alpha th \cdot L$ between the principal axis mode and the sub-axis mode must satisfy $\Delta\alpha th \cdot L \geq 1.0$ (¶ [0052]). In rejecting claim 1, the Examiner assumes that the cavity length L is 100 μm, which implies that $\Delta\alpha th \geq 100\ cm^{-1}$. The Examiner then calculates the ratio of $\Delta\alpha th/\alpha th$ to be greater than 1, because $7\ cm^{-1} \leq \alpha th \leq 51\ cm^{-1}$.

Based on the above description, it appears that the Examiner assumes that αth (the power threshold gain per unit length) of Aoyagi corresponds to the claimed threshold gain g_{th}. Applicants respectfully disagree. Paragraph [0019] of the present specification defines the threshold gain g_{th} as the sum of an internal loss α_i and a mirror loss α_m. However, as explained below, Applicants submit that αth of Aoyagi corresponds to the mirror loss α_m of the present specification, not the claimed threshold gain g_{th}. In order to further clarify the claimed invention, Applicants are amending independent claims 1, 16, 17, and 23 to recite that "the threshold gain g_{th} is the sum of an internal loss and a mirror loss."

Aoyagi discloses that a single-sided slope efficiency ηs is given by Equation 2 shown in paragraph [0053]: $\eta s = \left(\frac{0.62}{\lambda_p}\right) \cdot \eta i \cdot \left(\frac{\alpha th}{\alpha i + \alpha th}\right)$. As a person of ordinary skill in the art understands, the single-sided slope efficiency ηs is proportional to the term $\left(\frac{\alpha_m}{\alpha_i + \alpha_m}\right)$, where α_m is the mirror loss and α_i is the internal loss. This definition is supported by the disclosure of the attached document, published in the SEI Technical Review, No. 169, pp. 21-26, July 2006, in which the slope efficiency SE is defined as $SE \propto \eta i \cdot \left(\frac{\alpha_m}{\alpha_i + \alpha_m}\right)$ (lines 3-15; also see English translation of this passage). Based on a comparison of Equation 2 of Aoyagi and the slope efficiency SE as defined in the attached document, it is clear that αth of Aoyagi corresponds to the mirror loss α_m, not the threshold gain g_{th}.

Further, as explained in paragraph [0038] of the present specification, the parameters Δα (the mirror loss difference between the basic mode and an adjacent mode) and Δα·L have been used to evaluate the single-mode stability of DFB lasers. Similarly, Aoyagi discloses that in order to achieve a stable single axial mode, Δαth·L must be greater than or equal to 1.0 (¶ [0052]). However, the parameter Δα·L cannot be used to evaluate DFB lasers in which the resonator is designed to be very short, as in the present invention (¶¶ [0038] and [0039] of the present specification). Instead, the Applicants derived $\Delta\alpha/g_{th}$ as an indicator for evaluating the single-mode stability of DFB lasers with a very short resonator (¶ [0040] of the present specification). Aoyagi does not teach or suggest the use of $\Delta\alpha/g_{th}$ as an indicator, or that $\Delta\alpha/g_{th}$ is greater than or equal to 1, as recited in claim 1.

Applicants submit that claim 1 is patentable over Itaya and Aoyagi at least by virtue of the aforementioned differences, as well as its additionally recited features. Claims 2, 6, and 17 are patentable over Itaya and Aoyagi at least by virtue of their dependencies on claim 1, as well as their additionally recited features. Further, Applicants submit that McCall, Aoki, and Macomber each fail to remedy the deficiencies of Itaya and Aoyagi. Therefore, claims 4, 5, 7-16, 21, and 23 are patentable over Itaya, Aoyagi, McCall, Aoki, and Macomber for at least the reasons discussed above, as well as their additionally recited features.

III. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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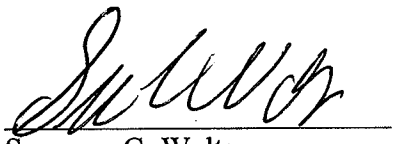
Respectfully submitted,



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